TECHNICAL SERVICE MANUAL

Servicing the Bilstein Black Hawk® 9300 Series
Radial Bypass Damper

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Thank you for choosing Bilstein products!

Bilstein Shock Absorbers, a division of ThyssenKrupp Automotive, is synonymous with high performance automotive dampers. Bilstein was the first manufacturer of the mono-tube shock absorber design. Decades later, the Bilstein mono-tube design is still considered the technological future of the shock absorber industry. Following its trends as the industry leader in innovation, Bilstein introduces the 9300 Series Black Hawk® Radial Bypass Damper (RBD).

The 9300 Series Black Hawk® Radial Bypass Damper continues Bilstein's development trend of producing evolutionary products that advance automotive damping technology to the next level. Bilstein's commitment to excellence includes not only providing leading technology to the market, but to both educate and support the enthusiast. By ensuring the availability of quality parts and service, Bilstein makes certain enthusiasts have the resources to achieve their performance goals.

This service manual provides specific instruction and recommendations for maintaining the components of the 9300 Series Black Hawk® Radial Bypass Damper, while educating the user about position sensitive, mono-tube damping technology.

Sincerely,
The Bilstein Team

Section 1

Glossary of Terms

***RBD**- *Radial Bypass Damper (External Bypass Shock absorber)*

***IFMV**- *Incremental Flow Metering Valve*

***ACV-** *Anti-Cavitation Valve*

Damper- *A device that decreases the amplitude of mechanical oscillations.*

Working Piston- *The component found at the end of the piston rod, inside of the damper housing, that separates the upper and lower quadrant of the oil chamber.*

Valving Shim- *Deflective metallic discs of varying diameter and thickness used to regulate oil flow in one direction of a working piston or ACV.*

Valve Stack- *A given series of deflective valving shims used for tuning a hydraulic damper (shock absorber) located on both sides of the working piston and Anti Cavitation Valve.*

Cover Shim- *A dual purpose valving shim of the greatest diameter, usually the first in the valve stack, which governs the direction of oil flow through the piston ports while contributing to the response of the valving stack when deflected. It acts as a check valve.*

Cavitation- **-** a) *The sudden formation and collapse of low-pressure bubbles in liquids by means of mechanical forces, such as those resulting from rotation of a marine propeller. This can occur at the valving shims and at the leading edges of ports as it relates to shock absorbers.* B) *The pitting of a solid surface.*

O-ring Gland- *The groove in which the o-ring seats.*

Tenon- *The reduced diameter, partially threaded stem located at the end of the piston rod that penetrates the working piston and valving components when assembled.*

Bump- *The compression stroke of the shock, compressing the damper towards it minimum length of travel in the direction of the chassis.*

Rebound- *The extension stroke of the damper when the wheel drops away from the chassis towards the ground.*

Sprung weight- *The chassis, all of its components and occupants supported by the suspension.*

Un-sprung weight- *The moving components of the suspension including the wheels/tires and brakes.*

SHCS- *Socket Head Cap Screw (Allen screw): Allen wrench, Allen key, hex key or hex head wrench is a tool used to drive screws and bolts with a hexagonal socket in the head.*

**Patent Pending on a component or assembly.*

Section 2

SPECIALIZED TOOL KIT

The specialized tool kit (part # B4-BOA-0000280) is available for customers who service and tune their own Black Hawk® 9300 Series Radial Bypass Dampers. It is highly recommended that the tools in the kit are used to service the dampers to ensure proper disassembly and reassembly procedures. The use of alternate tools can result in damaged parts and prolonged labor.

Torque tube coupling- The male-coupling *(figure 1)* passes through the spherical bearing found at each end of the shock and threads into the female coupling *(figure 2)* creating an indexed leverage assembly. The torque tubes, shown below in figure 3 and 4, slide over the protruding stem at either side of the coupling assembly. This permits a high level of hand-torque to remove or install the rod end and end cap. The tool assembly prevents damage to the aluminum bearing eyelet during service.

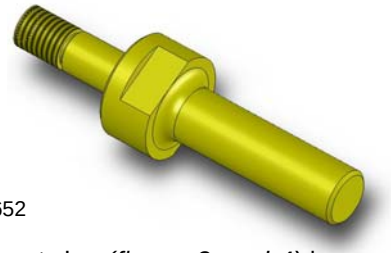


Figure 1
E4-BOA-0000652

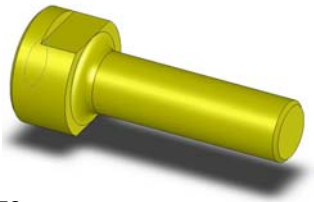


Figure 2
E4-BOA-0000653

Torque tube- The torque tube *(figure 3 and 4)* is a universal leverage device that is used on both the Torque Tube Coupling *(figure 1 and 2)* and the Flat Hex Wrench *(figure 5*).

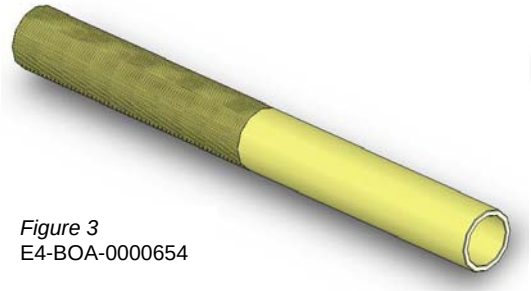


Figure 3
E4-BOA-0000654

Figure 4
E4-BOA-0000654

Flat Hex Wrench- The flat hex wrench is used to remove or install the dampers Rod Guide and the End Caps found on the External Reservoir. The Torque Tubes can be used for additional leverage by sliding them over the handles of the wrench. Also incorporated into the wrench are two #8-32 stainless Socket Head Cap Screws which act as spanner points to remove or install the Anti Cavitation Valve Lock Ring.

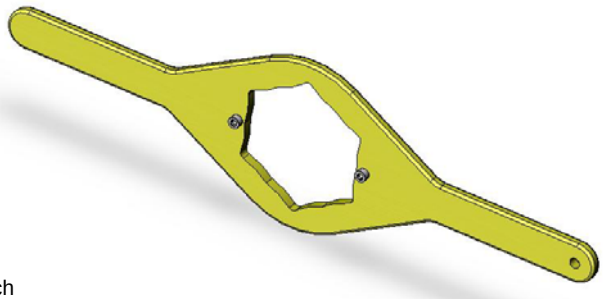


Figure 5
B4-BOA-0000278 assembly
Includes:
- (1) E4-BOA-0000657 wrench
- (2) 1000460 #8-32 Stainless SHCS

IFMV Press Pin with base, Rod Guide Bearing Press Pin- The press pin *(figure 6)* and base *(figure 7)* are used to remove the valve from the Incremental Flow Metering Valve housing without marring or otherwise damaging the component. The bearing press pin *(figure 8)* is used to remove and install the rod guide DU bearing.

Figure 6
E4-BOA-0000656

Figure 7
E4-BOA-0000655

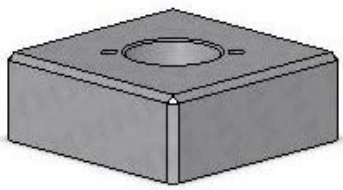


Figure 8
E4-BOA-0000658

Section 3

APPLICATION AND FUNCTION BASICS

The 9300 Series Black Hawk® Radial Bypass Damper (RBD) is an advanced version of an external bypass shock absorber commonly used on off-road racing vehicles. In general, the damper is used in conjunction with either second coil-carrying damper or alternate spring device such as a torsion bar. The bypass damper is meant to provide adjustable control at varying points of travel and controls the majority of the energy created at the spring when counteracting the sprung and un-sprung component weights on a vehicle. It is a tuning device that is meant to work with other suspension components as a system, not as a complete solution to other possible shortcomings in the design or selection of relative components. This must be understood when preparing a race vehicle with any variation of an external bypass damper.

The first details to consider prior to ordering the Black Hawk® RBD: *See specification work sheet*.

- Eligibility for the class the vehicle competes in
- Required travel lengths/total length of damper
- All clearance/space limitations
- Locations to mount the reservoir

External bypass technology gives the user the ability to alter the resistance of the damper both in bump (compression) and rebound (extension) strokes. Of the four bypass features, there are two Incremental Flow Metering Valves (IFMV) for bump and two for rebound. The bypass function is relevant to the position of the piston throughout its range of travel. The adjustment of each IFMV is achieved by changing the amount of oil flow past the valve. This is done by clicking the 3/8" hex adjuster into one of nine positions. A noticeable "click" is observed when performing adjustments to each ensuing setting chosen by the user.

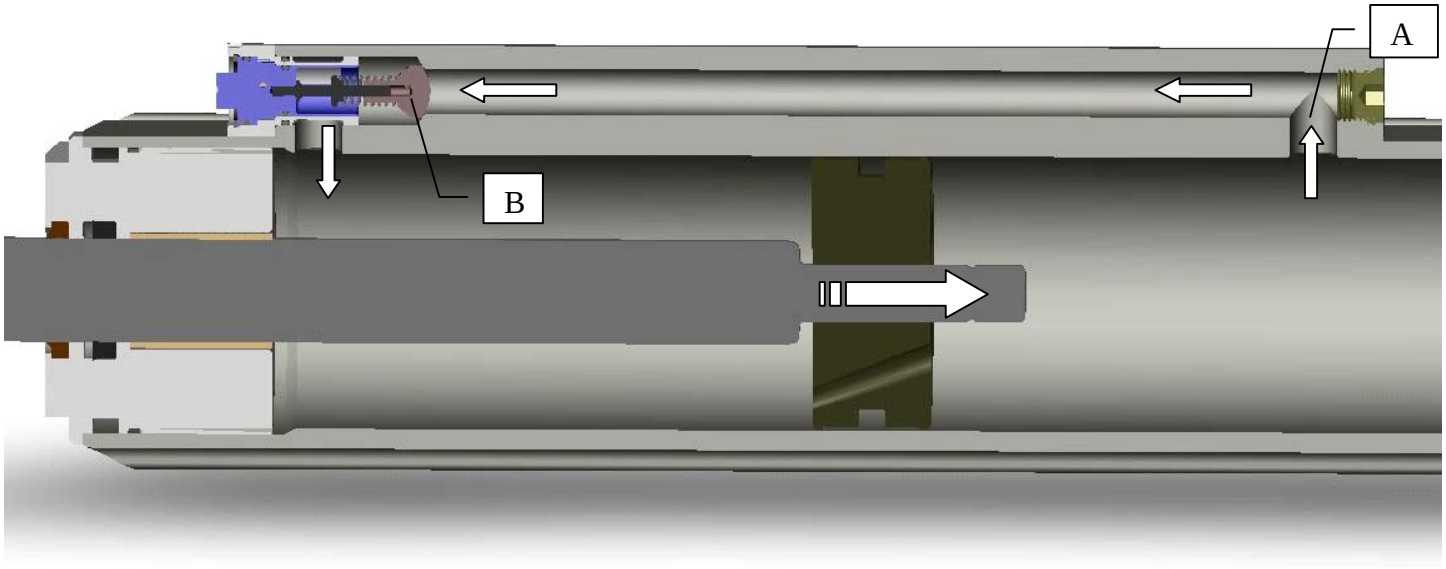
A simplified explanation of tuning the RBD is to view the damper as a device that governs the speed at which the wheels/suspension of the vehicle travel up and down over terrain and the effects that inherently translates to the chassis. A damper should only travel to full-bump in the most extreme condition, such as landing after being airborne or hitting a very abrupt obstacle at speed. The majority of the wheels' travel cycle, and therefore the damper, should be prior to its maximum upward travel position. This condition is usually termed "bottoming out". Not only will following this guideline improve speed, but it will preserve the dampers longevity (as well as the occupants). Tuning downward travel (rebound) is critical in that a tire can only do its job when in contact with the ground. Steering and power inputs can only be realized under this condition. Since the suspension and wheels carry a fair amount of weight, finding the setting that best suits the vehicle's overall performance capabilities is crucial. How quickly the wheels return to the ground is affected by the un-sprung weight of the suspension, wheels and the energy stored in the coil springs from a bump condition. The coil springs are constantly trying to push the wheels down, and once the force stored in the spring exceeds the weight of the vehicle, the chassis, or sprung weight, is pushed away from the ground. This is a common effect that can cause a vehicle to bounce upward or "kick" at one end of the vehicle, or both. Neither condition is beneficial.

The Black Hawk® RBD has two bump and two rebound IMFVs that can be used to tune the dampers bump and rebound strokes separately at two stages of travel. The initial stage will be the softest as two valves will permit a metered amount of bypass accumulatively and the second stage will only actuate one valve. Once the piston has traveled beyond both bypass ports for either bump or rebound, the valving found on the working piston will be experienced in its entirety. This final 3" of bump travel will further resist the weight of the vehicle.

As mentioned earlier, determining the spring rates for a vehicle are critical and ultimately play the largest role in properly tuning a race vehicle. The wrong choice will affect the overall performance and the dampers can only provide a reasonable amount of counteraction to the ill effects. If adjustment from the IFMV has been exceeded on one or more bypass ports then a re-valve should be considered. Major changes to spring rate may require re-valving the damper as well.

The following page illustrates the basic function of a position sensitive bypass, specifically the Black Hawk® RBD.

The bump (compression) stroke of the damper is illustrated below. As the piston travels towards the open intersecting ports (A), the oil flows in the opposite direction, deflecting the IFMV piston (B). The oil then flows through the valve at its pre-set position and to the backside of the working piston. This is the "bypass" function of this type of damper. The location of the open intersecting ports varies, hence the descriptive term "position sensitive bypass" as used in "position sensitive dampers". The placement of the bypass ports is reliant of the total stroke length of a given damper.



When the piston covers the open-intersecting bypass port, the bypass function will be disengaged entirely. This is also true as the piston travels beyond the port. This same dynamic function is observed during the rebound stroke of the damper and the IFMV is located at the opposite end of the bypass port, thereby governing the flow in the opposite direction from what is viewed in this image. During the rebound stroke, the bump IFMV sees equal pressure on both sides of its piston and will remain closed, or inactive. When the piston is beyond the bypass in its compression stroke, the valving found on the working piston and the ACV is governing flow/resistance in its entirety = no additional bypass.

DRAINING OIL FROM THE DAMPER

Thoroughly clean the shock assembly before removing components and disassembling.
Note: Harsh cleaning agents may etch the aluminum parts. Use soapy water and a soft scrub brush to remove all contaminants from the damper assembly. Thoroughly rinse and dry prior to disassembly.

RELEASE THE NITORGEN GAS PRESSURE AT THE FILL VALVE LOCATED ON THE RESERVOIR! DO NOT REMOVE ANY SEALED COMPONENTS UNTILL THIS IS PERFORMED!

Thoroughly draining the damper for service requires several steps to be repeated, ensuring that all oil has been drained from the assembly. Some procedures may only require partial draining of the oil, such as servicing the components found on or in the damper housing. These instructions will cover completely draining the oil from both the RBD and the remote reservoir.

Note: It is recommended that new oil is used anytime the damper is disassembled. If not replacing, have a clean container with a volume equivalent to a minimum of 1.5 gallons to store the oil during service.

1. Adjust all of the IFMV adjusters to fully open positions (clockwise)

2. Place the damper in a vice vertically with the piston rod facing upward and unscrew the rod guide. Follow the procedure explained in *Section 6*.

3. Remove RBD from the vise and drain the oil into a container. Hold the reservoir above the damper and repeat this process as need to allow the oil to drain from all cavities and ports within the assembly.

4. Place the RBD back into the vise. Unthread the reservoir hose from the RBD end cap using a 1¼" wrench and drain the oil into the container.

FILLING THE DAMPER WITH OIL

1. Place the reservoir vertically into the vise with the fill valve facing down and the hose inlet End Cap removed. Fill the reservoir chamber with oil to a level just below the End Cap thread relief.

Note: The dividing piston must be set into position prior to addition of oil. Reference the cutaway diagram of the reservoir in Section 5. The location is noted to the left of the image.

2. Install the hose inlet End Cap and fill with oil just below the -12 AN fitting.

3. Install the hose line and fill with oil to approximately half of its length.

4. Fasten the hose line to the RBD end cap. Place the RBD into the vise with the end cap facing down and fill the RBD with oil up to the thread relief. Allow the oil to settle in to the various cavities and ports within the RBD.

5. **Slowly guide the Piston Rod Assembly into the RBD with the stepped cut of the wear band clocked 180º from the bypass ports.** Cycle the piston rod assembly up and down several times taking care not to let the piston rotate. Do not thread the rod guide into the RBD housing at this time. This will help to force oil into all cavities and purge the air bubbles out.

6. Top off the oil level to the first thread inside the cylinder furthest from the top edge of the tube.

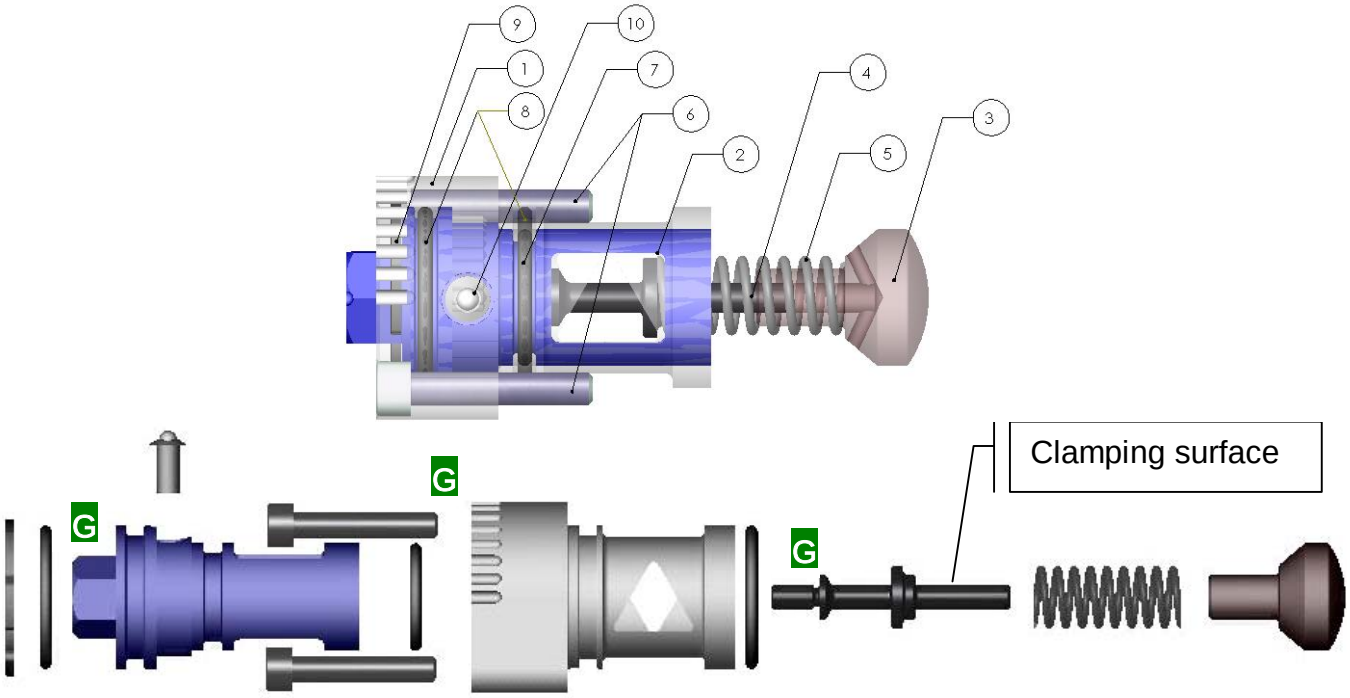
7. Thread the rod guide into the tube and tighten. Cycle the damper to ensure there are no obvious leaks.

8. Thoroughly clean the RBD of all oil residues. Pressurize the damper at the fill valve on the reservoir to 60psi and inspect for leaks.

9. Service is complete.

Section 4

INCREMENTAL FLOW METERING VALVE (IFMV)

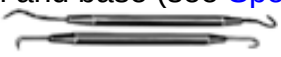


PLEASE READ INSTRUCTIONS THOROUGHLY BEFORE DISSASEMBLING THE COMPONENT!

PARTS LIST 9300 SERIES OFF-ROAD SHOCK

ITEM	PART NUMBER	DESCRIPTION	QTY
1	194641/E4-BOA-0000642	Check Valve Housing (rebound or bump)	1
2	E4-BOA-0000647/ 648	Valve (red and blue)	1
3	E4-BOA-0000650	Piston	1
4	E4-BOA-0000646	Piston Guide Pin	1
5	1000405	Spring	1
6	90128A151	Socket Head Cap Screw- 6-32 x .75"	2
7	1000414	O-ring	1
8	1000416	O-ring	2
9	5008-75	Internal Retaining Clip	1
10	84895A56	Ball-nose spring plunger	1

Tools: *The use of the specialty tools is highly recommended!*

- 3/8” wrench or socket.
- Internal Retaining Ring pliers- > Ø.042” tips
- 7/64” Internal Socket Wrench (Allen™ wrench)
- Valve press pin and base (see Specialized Tools)
- Seal Pick: ex. 

T Loctite® 271™- Thread locker

G Grease

C Clean (evaporative cleaner/de-greaser)

S Loctite® 564™ Thread Sealant with PTFE- general purpose

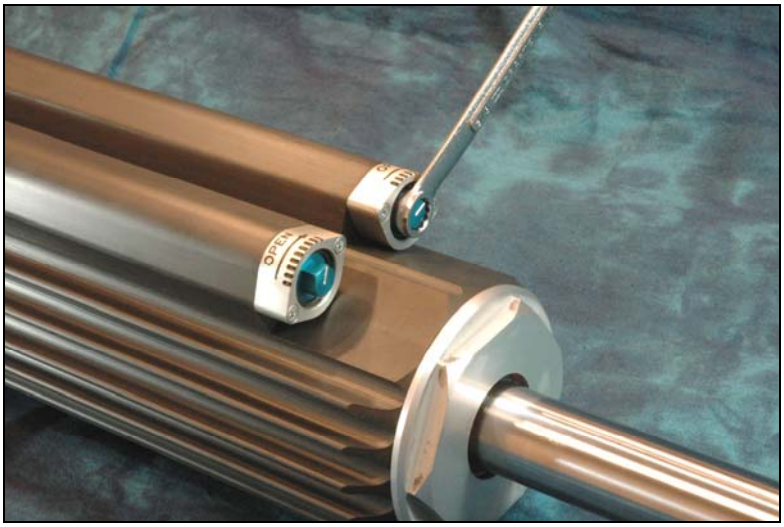
Index: Check Valve

5. Adjustment
   a. Function explained
   b. Performance Graph
6. Removal from Shock Tube
   a. Helpful tips
7. Disassembly
   a. Removing Valve
   b. Disassembly of Valve
   c. Inspection
8. Assembly
   a. Procedures and tips.

To order replacement parts, fill out the *online order form*. If you require assistance, please call our **Off-Road Motorsport** sales staff with all part numbers and part descriptions on hand. We will be happy to help you with your order. *1-858-386-5900*

1. Adjustment

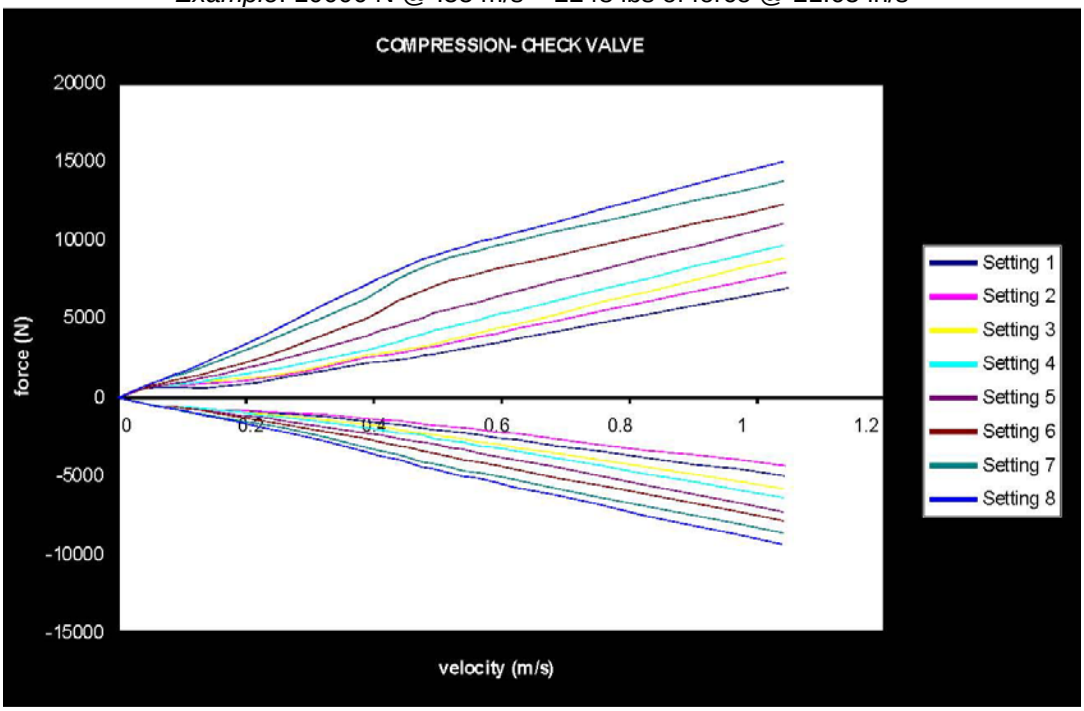
The IFMV has 9 settings ranging from completely closed to fully open. This setting is achieved by rotating the valve to the right (clockwise) to the last detent. Each of the nine settings has a noticeable "click" into each position and the valve will not adjust beyond the settings designed into the part. **DO NOT FORCE THE VALVE BEYOND ITS RANGE OF ADJUSTMENT!**



Each setting changes the force/velocity change, either positively or negatively, in a linear fashion. It is measured in Newton Meters per second. The chart below shows the change in force/velocity at each position of the IFMV adjuster. 'Setting 1' is fully closed= no bypass.

Conversions:
1 Newton = 0.2248089 pound-force
1 meter/second = 39.3700787 inch/second

Example: 10000 N @ .55 m/s = 2248 lbs of force @ 21.65 in/s



There are two valves for bump control (blue) and two for rebound (red). Each valve regulates the dampening force measured at the piston at different points of the travel range (stroke). This is position sensitive damping.

1. **Removal**

    a. **RELEASE THE GAS PRESSURE AT THE SCHRADER VALVE LOCATED ON THE RESERVOIR!**

    b. Thoroughly clean the shock assembly before removing components.

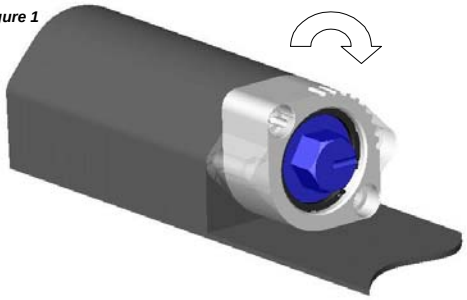
Note: Harsh cleaning agents may etch the anodized parts. Use soapy water and a soft scrub brush to remove all dirt from the shock assembly.

    c. To remove the check valve assembly from the shock, unthread the #6-32 Socket Head Screws with a 7/64" Internal Socket wrench (Allen™ wrench). Clean the threads and apply a suitable anti-seize compound to each Socket Head Screw prior to reinstalling.

    d. Rotate the check valve (it will stop against the flat surface of the shock tube) so an edge is exposed beyond the profile of the raised bypass port *(figure 1)*. Carefully pull the check valve out from the port. Do not use a tool to pry or tap the check valve out. This can damage the mating surface of the check valve and tube. Twisting the assembly to the left and to the right while pulling can help to reduce the friction between the o-rings and the port surface. (f*igure 2)*

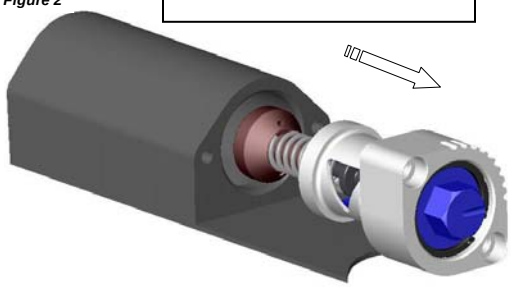
Rotate then pull out.

Figure 1



Remove the piston and spring if they remain in the port.

Figure 2



2. **Disassembly**

Always thoroughly clean and inspect all components after disassembly. Any damaged parts should be replaced to ensure proper function.

    e. Remove the Internal Retaining ring (part # 5008-75, Item 9) with the appropriate Retaining Ring pliers and *tips.

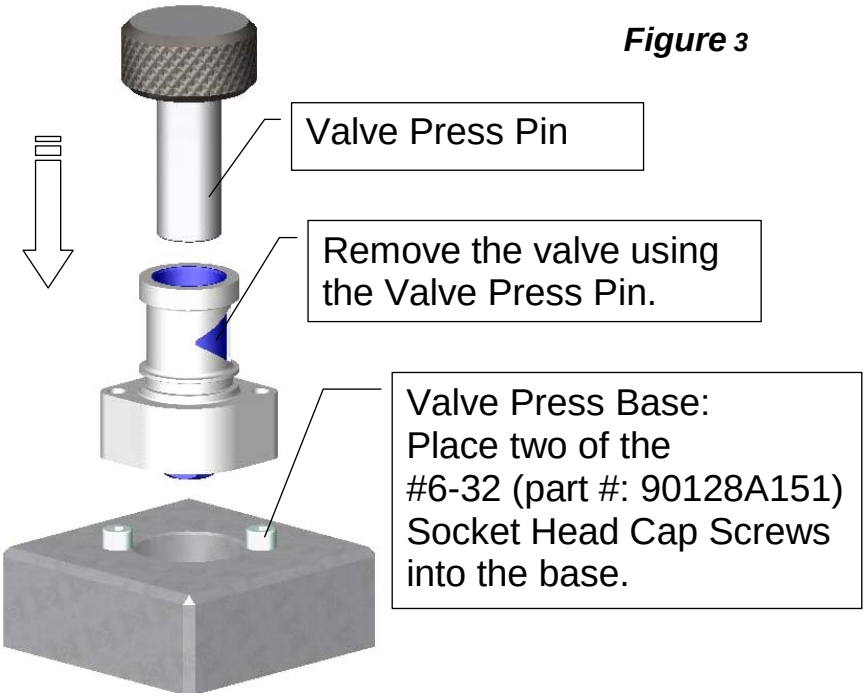
        **The holes of the retaining ring are Ø.042".*

    f. Place the tip of the piston guide pin in to a vise equipped with "soft jaws". Do not clamp the guide pin with pliers or unprotected vise jaw! Using a 3/8" wrench or socket, rotate the valve to the left (counter-clockwise) to unthread the guide pin.

**This step is necessary to avoid damaging the guide pin when pressing out the valve as explained in step 3c. Damage to the guide pin may result in piston failure or poor performance due to binding.*

c. Place the Assembly on the check valve press base and indexed to the #6-32 Socket Head Screws. The screw heads will fit into the counter bores on the Valve Housing. *(figure 3)* Press the valve out of the housing using the Press-pin tool and by hand or adequate arbor press.

Figure 3


Valve Press Pin
Remove the valve using the Valve Press Pin.
Valve Press Base: Place two of the #6-32 (part #: 90128A151) Socket Head Cap Screws into the base.

d. Remove the o-rings (part #'s 1000414, 1000416) using a seal pick. Be cautious not to scratch the o-ring gland.

4. Assembly:

a. Replace with new o-rings (part #'s 1000414, 1000416) after all parts have been thoroughly cleaned. Apply a conservative coating of oil or grease to the new o-rings prior to pressing the valve into the IFMV housing. *(Optional assembly tools shown. See "Specialty Tools" list)*. Be cautious not to damage the o-rings when performing this procedure. They must remain seated evenly in the o-ring gland or risk being cut when passing across edges within the IFMV housing.

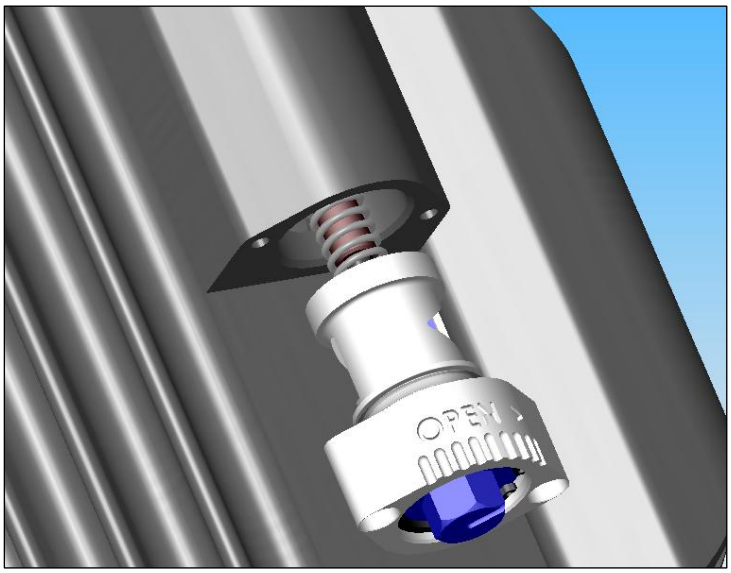
b. Using a 3/8" wrench, adjust the valve to each of the 9 settings to ensure proper function and to seat the new o-rings.

**When installing the Valve, be sure to index the detent ball with one of the notches found on the inner bore of the Valve housing. Failing to do so may damage the detent ball and/or the housing itself.*

c. Install the piston guide pin after placing a small amount of thread locking compound. The pin should be hand tight. Do not over tighten the fine threads or damage may occur to both the pin and the valve.

d. The IMFV piston and spring is not fixed to the piston guide pin until it is installed into the port. The RBD housing should be angled so the IMFV assembly can be installed with the piston facing upward *(figure 4)*. Once in place and the Socket Head Screws are installed, the piston will be in contact with its sealing surface within the port and the spring will have a pre-load force upon it.

Figure 4



e. Torque the Socket Head Cap Screws *(part # 90128A151)* 3 ft-lb ± .5 after applying a small amount of anti-seize compound.

f. Service is complete.

Section 5

Servicing the Remote Reservoir components

PLEASE READ INSTRUCTIONS THOROUGHLY BEFORE DISSASEMBLING THE COMPONENT!

PARTS LIST 9300 SERIES OFF-ROAD SHOCK

ITEM	PART NUMBER ('s)	DESCRIPTION	QTY.
1	E4-BOA-0000805	Tube, Reservoir	1
2	E4-BOA-0000806	End Cap, Fill Valve	1
3	E4-BOA-0000807	End Cap, -12 AN	1
4	E4-BOA-0000808	Anti Cavitation Valve (ACV)	1
5	E4-BOA-0000809	Piston, Dividing	1
6	E4-BOA-0000810	Lock Ring	1
7	194001	Wear Band, Dividing Piston	1
8	1000422	O-ring, Dividing Piston	1
9	1000423	O-ring, End Caps	2
10	90101A252	Nut, Nylon locking	1
11	90298A796	Bolt, Shoulder- Socket Head	1
12	194754	Washer, Backing	2
13	194755	Washer, Spacer	2

Valving shim part numbers are shown in Figure 2.

Tools: *The use of the Bilstein specialty tools is highly recommended!*

- Flat Hex Wrench *B4-BOA-0000280*
- Torque Tubes (2) *E4-BOA-0000654*
- Vise with "Soft Jaws"
- 1 ¼" wrench - open-end
- Seal Picks
- Non-marring Strap Wrench
  (RIGID or Klein tool brands recommended)

Index: Reservoir Assembly

Section View

1. Disassembly- End Caps
   a. Reservoir
   b. Hose
      1. End caps
   b. ACV
      1. Lock ring
      2. Valving

2. Assembly
   a. Procedures and tips.

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**Please call our Off-Road Motorsport department for assistance with revalving.*

Symbols defined: Apply to components prior to reassembly. Loctite® brand recommended but equivalent may be used.

T Loctite® 271™- Thread locker

G Grease

C Clean (evaporative cleaner/degreaser)

S Loctite® 564™ Thread Sealant with PTFE- general purpose

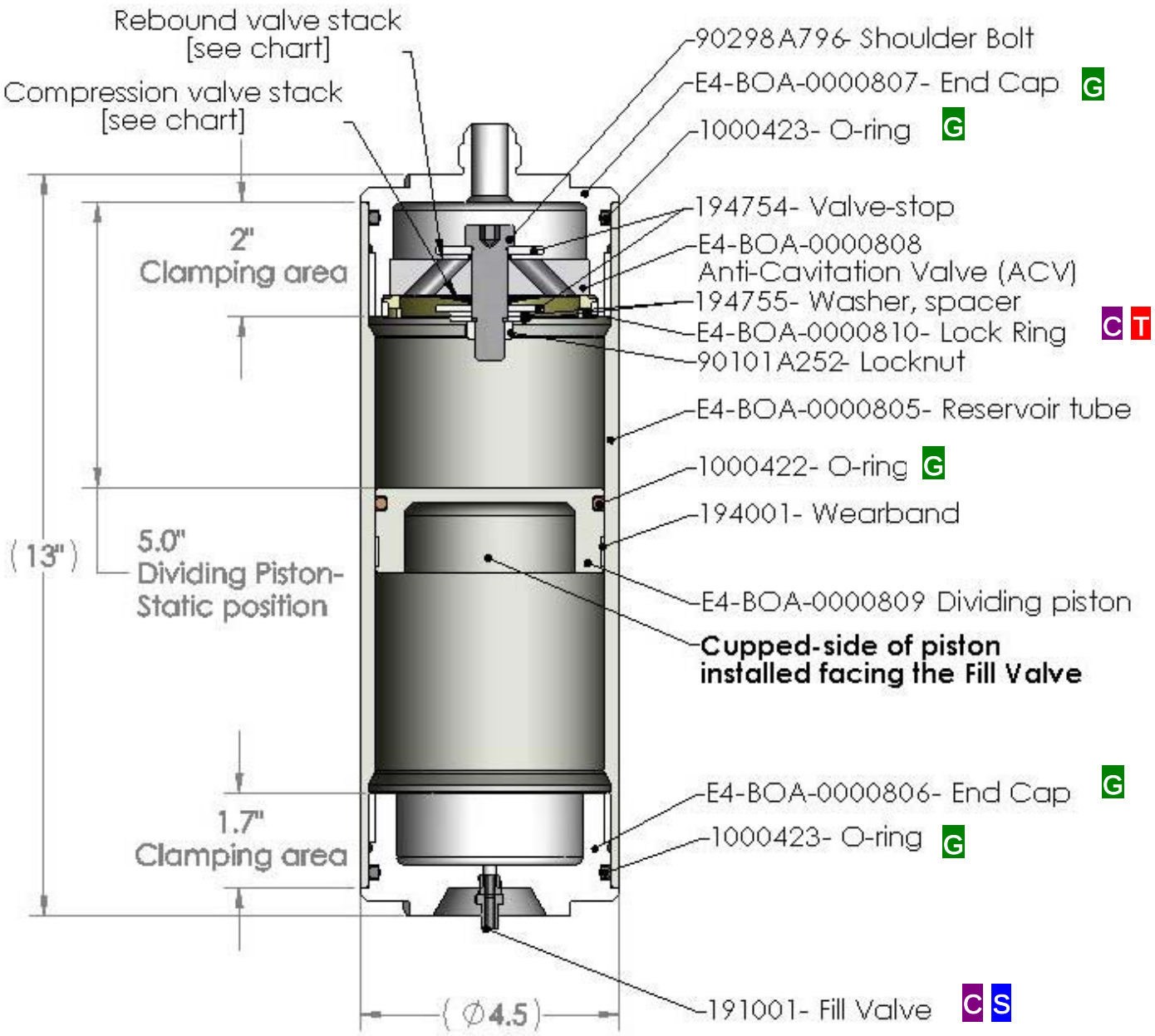


Figure 1

Note: The areas noted as a "Clamping area" are for fastening the reservoir to a fixed location on the chassis. Fastening devices located at points other than the areas noted can cause deformation of the reservoir, preventing smooth movement of the dividing piston at that point.

The components and method of attachment must be adequate for a component of this size and weight. Failure of the attachment device may lead to damage of the reservoir.

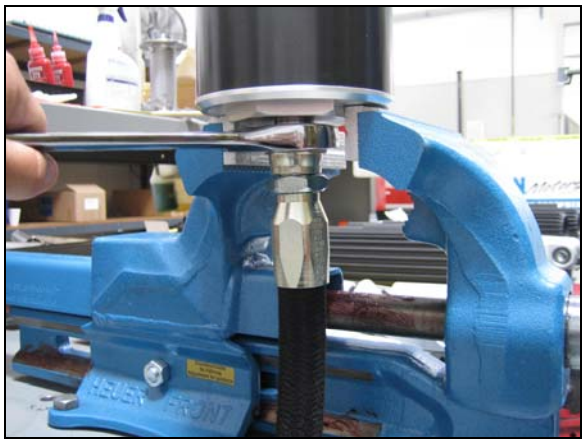
1. End Caps

a. Thoroughly clean the shock assembly before removing components and disassembling. ***Note: Harsh cleaning agents may etch the aluminum parts. Use soapy water and a soft scrub brush to remove all contaminants from the damper assembly. Thoroughly rinse and dry prior to disassembly.***

b. **RELEASE THE NITROGEN (N) GAS PRESSURE AT THE FILL VALVE LOCATED ON THE RESERVOIR**! See *section 3* instructions for draining the oil from the damper prior to servicing internal components.

c. Disconnect the hose line from the reservoir using a 1 ¼" open wrench and a non-marring strap wrench (RIGID or Klein tool brands recommended) *(photo 2 and 3)*. If a bench vise is available, the hex feature found on the reservoir end cap may be clamped between "soft jaws" and the hose end loosened from beneath with a 1 ¼" open-end wrench *(photo 1)*.

Photo 1



d. Remove the end caps using and a bench vise equipped with soft jaws, and a non-marring strap wrench. The flat hex wrench may be used if a vise is not available to unthread the end cap from the reservoir housing.

Note: The end caps incorporate standard right-hand thread.

Photo 2

Photo 3

e. If replacing the o-rings *(part # 1000423)*, use a seal pick to carefully pry the o-ring from the groove (gland). Do not scratch the groove surface with the pick tool.

f. Install the new o-ring by carefully rolling it over the threads of the housing into the groove. Do not twist/rotate the o-ring in the direction of the threading or damage will occur.

2. ACV (Anti-Cavitation Valve) *Patent Pending*

a. Place the hex feature of the end cap hex into a vice equipped with soft jaws. Loosen the lock ring *(part # E4-BOA-0000810)* using the flat hex wrench *(photo 4-5)*. Notice the two SHCS on the wrench. *(photo 4)* The heads of the screws fit into the notches machined into the lock ring. Remove the lock ring *(photo 6)*, exposing the ACV *(photo 7)* and remove the assembly.

Photo 4

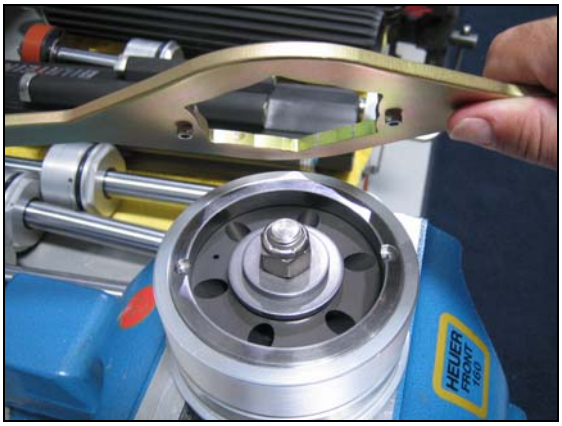


Photo 5

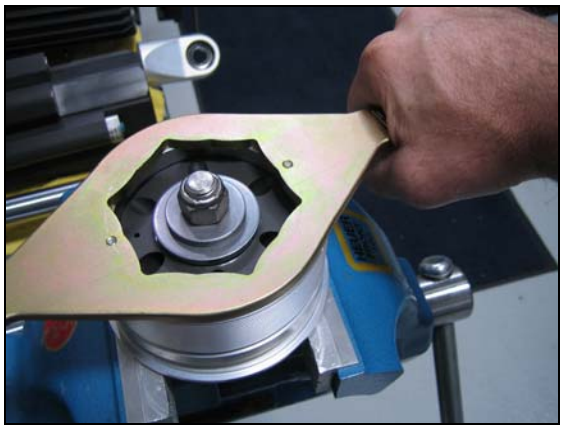


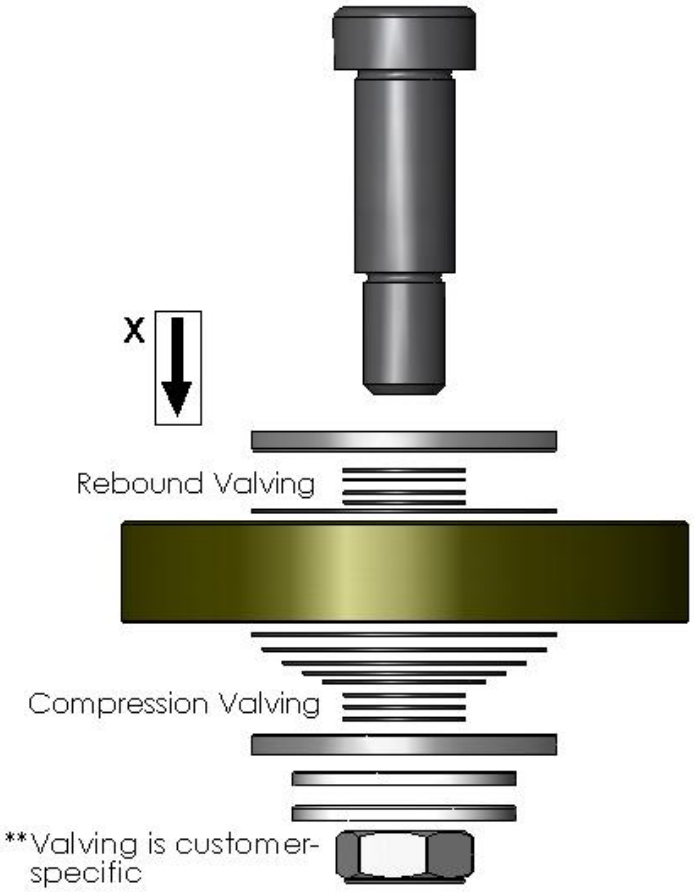
Photo 6

Photo 7

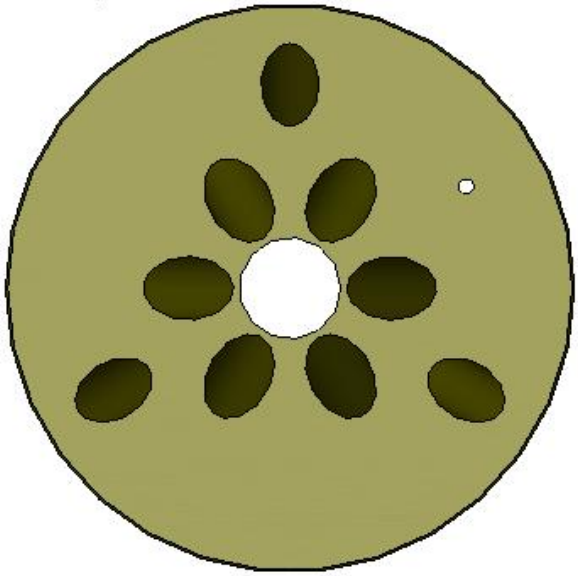
b. Remove the ACV assembly from the End Cap housing. Remove the nylon lock nut using a 3/8" internal hex wrench and ¾" socket wrench.

c. Remove the stepped SHCS. Keep all of the valving shims and washers in the same order as they were prior to disassembly *(figure 8)*. Clean and carefully inspect each shim before reassembling. Do not allow any media, such as grit/debris or lint from shop towels, to be trapped between the shims.

Figure 8



X : This side of the ACV faces the hose inlet located on the Reservoir End Cap. The flow of oil during the compression stroke of the damper passes through the 3 ports furthest from the center.



d. After assembling all components and installing the stepped SHCS, torque the lock nut to **50 ft/lbs**. Do not over tighten/under tighten the lock nut. This can affect both the durability and tuning accuracy of the valve shims via cupping.

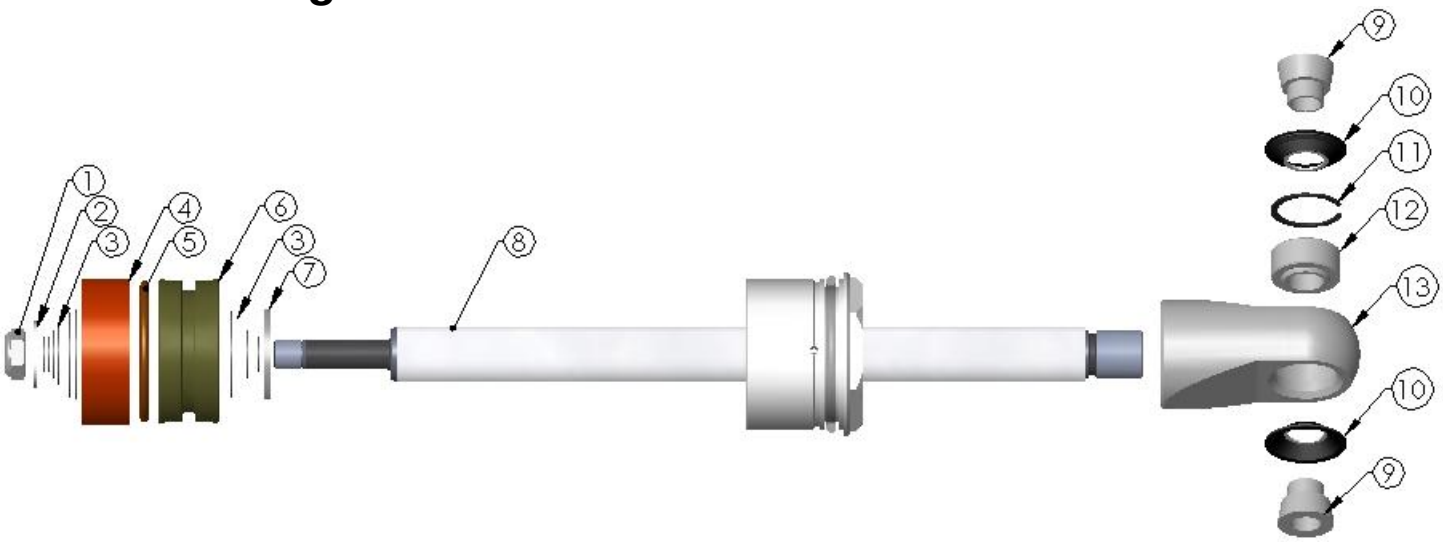
e. Install the assembly in the reverse order of removal. Apply a light coating of thread locking compound (Loctite™ 271) to the Lock Ring and allow setting for several minutes. Tighten the lock ring firmly into position using the flat hex wrench.

f. Install the reservoir inlet end cap assembly into the reservoir tube.

g. Service is complete.

Section 6

Servicing the Piston Rod and Rod Guide Assemblies



PLEASE READ INSTRUCTIONS THOROUGHLY BEFORE DISSASEMBLING THE COMPONENT!

PARTS LIST 9300 SERIES OFF-ROAD SHOCK

ITEM	PART NUMBER ('s)	DESCRIPTION	QTY.
1	90566A235	5/8-18 Short Nylock Nut	1
2	194755	Washer (Valve stack spacer)	-
3	*Customer specific	Valve shims	-
4	SP4-8342-047	Wear band (Piston)	1
5	1000420	O-ring (Piston)	1
6	E4-BOA-0000615	Piston	1
7	E4-BOA-0000641	Washer (valve shim break)	1
8	E4-BOA-0000621 622/624626/628	Piston Rod	1
9	E4-BAO-0000606	Bearing spacer, ½" ID	2
10	E4-BOA-0000601	Bearing cup seal	2
11	5008-143	Internal retaining ring	1
12	194477	Spherical bearing	1

Index: Piston Rod Assembly

3. Disassembly
   d. Rod End
      1. Bearing components
      2. Piston components
   b. Piston

4. Assembly
   e. Procedures and tips.

To order replacement parts, fill out the *online order form*. If you require assistance, please call our **Off-Road Motorsport** sales staff with all part numbers and part descriptions on hand. We will be happy to help you with your order. *1-858-386-5900*

Tools: *The use of the specialty tools is highly recommended!*

- Flat hex wrench- *see Special Tools*.
- Internal Retaining Ring Pliers- < Ø.076" tips
- Vise with "soft jaws"
- Non-marring strap wrench
- Seal Picks

**Please call our Off-Road Motorsport department for assistance with revalving.*

T Loctite® 271™- Thread locker

G Grease

C Clean (evaporative cleaner)

S Loctite® 564™ Thread Sealant with PTFE- General Purpose

1. Piston Rod Assembly

Note: If only replacing the rod end and/or its components, removal of the piston rod assembly from the RBD housing is not required. Skip to step 2.

a. Thoroughly clean the shock assembly before removing components and disassembling. ***Note: Harsh cleaning agents may etch the aluminum parts. Use soapy water and a soft scrub brush to remove all contaminants from the damper assembly. Thoroughly rinse and dry prior to disassembly.***

b. **RELEASE THE NITROGEN (N) GAS PRESSURE AT THE FILL VALVE LOCATED ON THE RESERVOIR**! See *section 1* instructions for draining the oil from the damper prior to servicing internal components.

c. Place the RBD with the rod guide down, in a vise equipped with soft jaws. Clamp on to the flat faces of the hex feature on the rod guide housing. Do not clamp any part of the RBD housing itself. If a vice is not available, place the RBD on a padded solid surface and use the use a non-marring strap wrench and flat hex wrench to break the rod guide loose.

d. Place the strap wrench over the RBD housing and position it close the rod guide. Loosen the RBD housing from the rod guide.

e. *Slowly slide the piston rod assembly up and out of the RBD housing. If you choose not replace the oil, caution must be observed to prevent spillage and contamination when removing the piston rod assembly

**There will be resistance when pulling the piston rod assembly out of the RBD housing. A small bleed port is located in the piston allowing the oil above it to flow downward to the opposite side of the piston.*

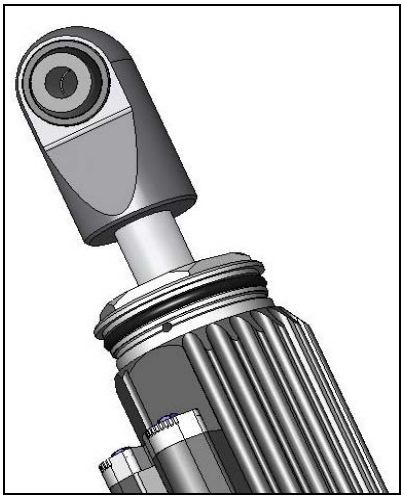


Figure 1

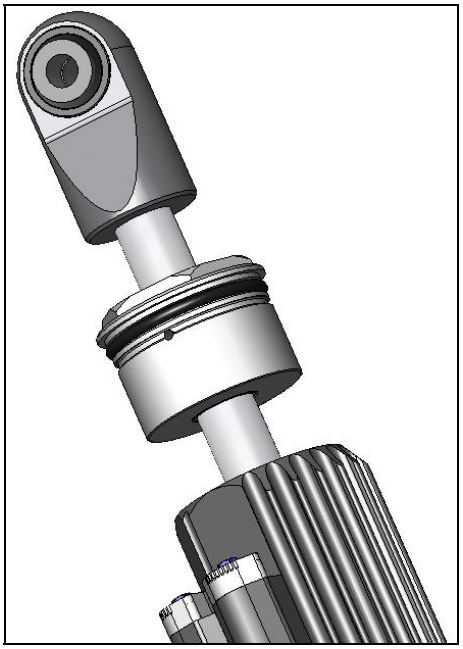


Figure 2

Figure 3

2. Rod End

a. Generally, the rod end should not be removed from the piston rod unless it is to be replaced or additional service to other parts is required. To remove the rod end, the piston rod must be firmly clamped in a vise or press equipped with aluminum or brass soft-jaws. Support the damper assembly if the piston rod is not removed from the assembly. *(photo 1)*

b. Install the torque tube coupling tool through the bearing *(photo 1)* and tighten snug against the flats of the rod end using a pair of 1 ½" wrenches. Do not over tighten the coupling tool or damage may occur to the aluminum rod end.

c. Use the torque tube coupling and tubes to break the rod end loose. Firmly secure the wrench jaws on the flat surfaces of the rod end and rotate counter clockwise. *(photo 2)*

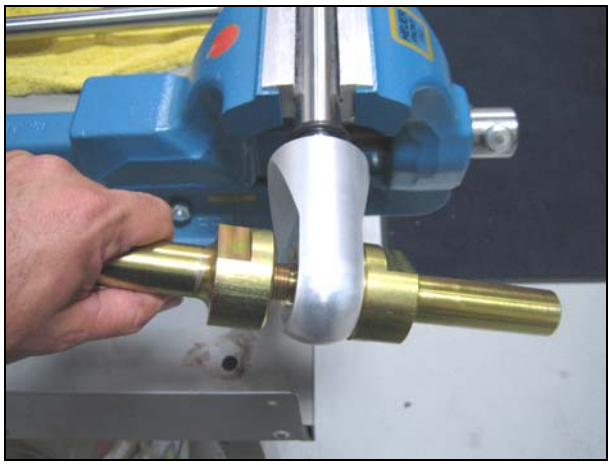


Photo 1

Photo 2

Note: Apply a thread locking compound to the threads prior to reassembly. Assemble in the reverse order of instructions 2a-2b.

d. Remove the internal retaining ring *(part* # 5008-143) using internal retaining ring pliers with tips adequate for the Ø.076" holes.

e. Press out the bearing assembly with a press tool of the correct diameter. Do not press on the spherical bearing itself. Thoroughly clean the bore with an evaporative cleaner.

3. Piston

a. Remove the lock nut *(part # 90566A235)* from the Tenon with a 15/16" wrench and remove the washers, valve shims and piston, laying them out on a clean surface in the same sequence as they were removed.

b. Clean and carefully inspect each shim before re-assembling. Do not allow any media, such as grit/debris or lint from shop towels, to be trapped between the shims.

c. Slide the rod guide off the piston rod

4. Assembly

a. Install the components in the reverse order of disassembly. Tighten the lock nut to **50 ft/lbs**. Apply a thin layer of hydraulic oil to the piston rod prior to installing the rod guide assembly. This will prevent seal damage when sliding it into position. See *section 7* for rod guide service instructions.

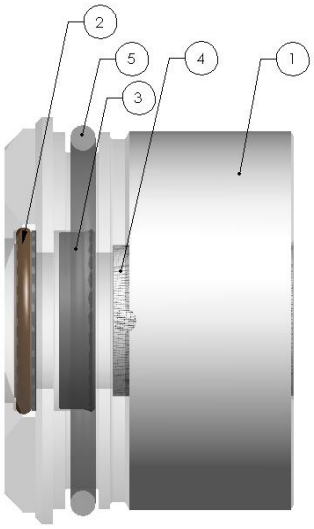
b. Carefully plunge the piston rod assembly, allowing the piston wear band to align with the cylinder wall. Slowly push the piston down giving he oil time to displace through the bleed hole.

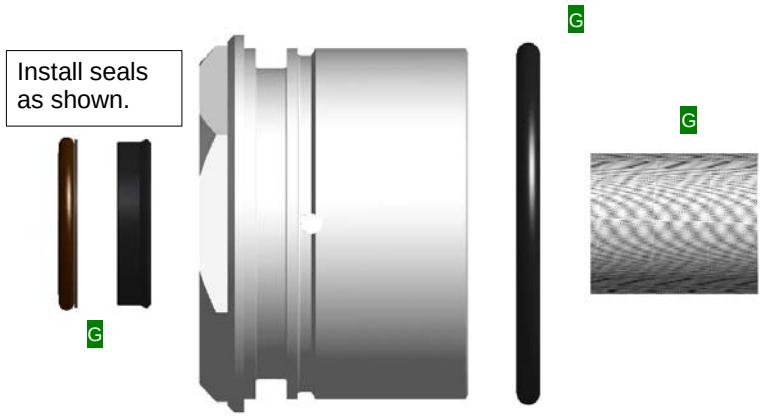
c. Using the Bilstein flat wrench, thread the rod guide into the RBD housing. Tighten the rod guide assembly with the flat hex wrench so that it is firmly seated to the top edge of the RBD housing.

d. Service is complete.

Section 7

SERVICING THE ROD GUIDE ASSEMBLY





PARTS LIST 9300 SERIES OFF-ROAD SHOCK

ITEM	PART NUMBER	DESCRIPTION	QTY.
1	E4-BOA-0000604	Rod Guide Housing	1
2	194045	Wiper Seal w/ O-ring backer	1
3	18701125-312b	Rod Seal	1
4	18DP24	Sleeve Bearing	1
5	1000421	O-Ring	1

Tools:

- Optional Bilstein 2 ¾" Hex Wrench- *see* *Special Tools*
- Bilstein Bushing Press-Pin- *see* *Special Tools*
- Seal Picks
- (A) Ø 3/16" x L1.5" min. punch, ex.

- Anti-seize (for Rod Guide Housing thread)

T Loctite® 271™- Thread locker

G Grease

C Clean (evaporative cleaner)

S Loctite® 564™ Thread Sealant with PTFE- General Purpose

Index: Rod Guide

2. Disassembly
   i. Seals
   j. Sleeve Bushing
6. Assembly
   k. Procedures and tips.

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1. Rod Guide

a. Reference the instructions in *Section 6- Part 1* and *Part 3* regarding the steps required to remove the rod guide from the piston rod.

b. Removing the seals and o-rings can be done using a seal pick. Carefully pry the seal and wiper out from the gland and remove from the rod guide housing *(picture 1-3, next page)*. Never reuse a seal once it has been removed.

Photo 1

Photo 2

Photo 3

c. Removing the sleeve bearing requires deforming it using a 5/16 punch. The rod guide housing has access ports on two sides, 180º apart located just below the O-ring. Place the hex feature of the rod guide into a vise equipped with vise jaws and clamp tight.

d. Using the punch and hammer, carefully distort the bushing inward from both sides until there is approximately 1/8- 5/16 of an inch of the top edge of the bearing visible in two places *(photo 5).*

Photo 4

Photo 5

e. Use the *press-pin* tool and an arbor press to push out the bearing from the rod guide housing *(picture 6-7)*. Insert the press pin from the hex-feature side of the housing.

Photo 6

Photo 7

f. Inspect the inner bore surface to ensure there are no burs or flakes of aluminum in or around it and thoroughly clean with an evaporative cleaning solution. Photo 8-9 illustrates the old and new bearing for reference.

Photo 8

Photo 9

2. Assembly

a. Lightly grease the new bearings outer surface. Index the bearing with the stepped end of the press pin and place into the arbor press. *(photo 9)* In one smooth motion, press the new bearing into the rod guide housing. Seat the bearing flush to the smooth face of the rod guide housing.

Photo 10

b. Lightly grease the outside diameter of the new seals *(photo 11)*. Install the new seals by squeezing the center, deforming the seal into an oval shape, and pushing it into the gland *(photo 12).* Grease the exposed surfaces of the installed seals prior to installing onto the piston rod *(photo 13).*

Photo 11

Photo 12

Photo 13

c. Slide the assembly onto the piston rod in the reverse order of removal (see exploded assembly view at the beginning of this section).

d. Service is complete.

COMING SOON

Specification Work Sheet

and

Online Order Form